ICC (IS-STM) CONSENSUS COMMITTEE ON ICC/NSSA 500 Standard for the Design and Construction of Storm Shelters

RECONSIDERATION BALLOT ON COMMITTEE ACTIONS FOR 03-01-23

This Ballot is due to the ICC office
Friday, Nov. 17, 2023

Instructions
This is the reconsideration ballot for Proposal 03-01-23 for the 2023 edition of the ICC/NSSA 500 Standard for the Design and Construction of Storm Shelters (IS-STM). Each member of the IS-STM is required to submit a vote for the balloted questions. Please mark the applicable vote. A reason must accompany any NEGATIVE or ABSTAIN vote. These reasons or any AFFIRMATIVE WITH COMMENT should be included in the ballot and submitted to ICC with the completed ballot form. Only current IS-STM committee members are eligible to submit ballots, and all ballots are conducted in accordance with ICC's ANSI Approved Consensus Procedures.

The completed ballot is due to the ICC office by 12:00 PM PST Nov. 17, 2023 by e-mail or mail.

By mail to: International Code Council
Central Regional Office
4051 Flossmoor Road
Country Club Hills, IL 60478

Or by e-mail to: kpaarlberg@iccsafe.org

Question: ICC/NSSA 500-2023
Do you approve the reconsideration of 03-01-23 for the draft of ICC/NSSA 500-2023, Standard for the Design and Construction of Storm Shelters in accordance with ICC's ANSI-approved standard development procedures?

Voting

I, _____,
(Print Name)

☐ Vote **AFFIRMATIVE** for the further revision to the Committee Actions shown in the following ballot
(There is no need to mark the ballot below)

☐

Vote **NEGATIVE** for the further revision to the Committee Actions shown in the following ballot.

(Mark the Ballot as appropriate only for votes of "NEGATIVE" or "ABSTAIN", or votes of "Affirmative with Comment" There is no need to mark for an AFFIRMATIVE vote)

A reason must accompany any AFFIRMATIVE WITH COMMENT, NEGATIVE WITH COMMENT or ABSTAIN WITH REASON vote.

Signed: _____representing _____
(Signature required)

Date: _____

Note: This ballot relates to the committee actions on the proposals, ballot and public comments submitted on the 2020 edition of ICC 500. The related documents are also published on the ICC 500 Webpage, then under Second Draft Development for the Public Input Agenda.

IS-STM 03-01-23

Item # IS-STM 03-01-23		**Committee action:** *Approved as Submitted with the reconsideration*		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Your Vote:				
Your comment/reason:				

Recirculation ballot of 03-01-23

The following is the history for 03-01-23. The reconsideration requested follows the committee action report.

Chapter 3

STRUCTURAL DESIGN CRITERIA

IS-STM 03-01- 23

302.2, 302.3

Proponent: ICC 300 Work Group 3

Revise as follows:

SECTION 302
LOAD COMBINATIONS

302.1 General. The *storm shelter* shall be designed to resist the load combinations specified in Section 302.2 or 302.3. *Storm shelters* that are designed as combination tornado and *hurricane shelters* shall comply with requirements for both sets of load combinations using either Section 302.2 or 302.3.

302.2 Strength design. Where strength design or load and resistance factor design (LRFD) is used, *storm shelters* and portions thereof shall be designed to resist the most critical effects resulting from the following combinations of factored loads. Each load combination shall also be investigated with one or more of the variable loads set to zero.

For *tornado shelters*:

~~1.4D (Equation 3-1)~~

1.2D + 1.6L_T + 0.5L_{rT} **(Equation 3-2)**

1.2D + 1.6L_{rT} + (L_T or 0.5W_T) **(Equation 3-3)**

1.2D + 1.0W_T + L_T + 0.5L_{rT} **(Equation 3-4)**

0.9D + 1.0W_T **(Equation 3-5)**

For *hurricane shelters*:

~~1.4D (Equation 3-6)~~

1.2D + 1.6L+ (0.5~~(L_{rH}~~ or 1.0R_H) **(Equation 3-7)**

1.2D + (1.6~~(L_{rH}~~ or 1.0R_H) + (L or 0.5W_H) **(Equation 3-8)**

1.2D + 1.0W_H + L + (0.5~~(L_{rH}~~ or 1.0R_H) **(Equation 3-9)**

0.9D + 1.0W_H **(Equation 3-10)**

In addition, for Hurricane Shelters subject to the requirements of Section 402.1 and located in:

Coastal high-hazard areas or a *Coastal A Zone:*

1.2D + 1.0W_H + 2.0F_{aH} + L + 0.5(L_{rH} or R_H) (Equation 3-11)

$0.9D + 1.0W_H + 2.0F_{aH}$ (Equation 3-12)

All other locations:
$1.2D + 0.5W_H + 1.0F_{aH} + L + 0.5(L_{rH}$ or $R_H)$ (Equation 3-13)
$0.9D + 0.5W_H + 1.0F_{aH}$ (Equation 3-14)

302.3 Allowable stress design. Where allowable stress design (ASD, working stress design) is used, storm shelters and portions thereof shall be designed to resist the most critical effects resulting from the following combinations of loads. Each load combination shall also be investigated with one or more of the variable loads set to zero.

For Tornado Shelters:
$D + L_T$ (Equation 3-15)
$D + L_{rT}$ (Equation 3-16)
$D + 0.75L_T + 0.75L_{rT}$ (Equation 3-17)
$D + 0.6W_T$ (Equation 3-18)
$D + 0.75L_T + 0.75(0.6W_T) + 0.75L_{rT}$ (Equation 3-19)
$0.6D + 0.6W_T$ (Equation 3-20)

For Hurricane Shelters:
~~D + L~~ ~~(Equation 3-21)~~
D + (L_{rH} or 0.7R_H) (Equation 3-22)
D + 0.75L + (0.75~~(~~L_{rH} or 0.7R_H) (Equation 3-23)
$D + 0.6W_H$ (Equation 3-24)
D + 0.75L + $0.75(0.6W_H)$ + (0.75~~(~~L_{rH} or 0.7R_H) (Equation 3-25)
$0.6D + 0.6W_H$ (Equation 3-26)

In addition, for Hurricane Shelters subject to the requirements of Section 402.1 and located in:
Coastal high-hazard areas or a *Coastal A Zone:*
$D + 0.6W_H + 1.5F_{aH}$ (Equation 3-27)
$D + 0.75L + 0.75(0.6W_H) + 0.75(L_{rH}$ or $R_H) + 1.5F_{aH}$ (Equation 3-28)
$0.6D + 0.6W_H + 1.5F_{aH}$ (Equation 3-29)

All other locations:
$D + 0.75L + 0.75(0.6W_H) + 0.75(L_{rH}$ or $R_H) + 0.75F_{aH}$ (Equation 3-30)
$0.6D + 0.6W_H + 0.75F_{aH}$ (Equation 3-31)

Reason:
The intent of this proposal is to update load combinations to remove inadvertent, overly conservative load factors on Rain loads.
This proposal reduces load factors for Rain loads where we have inadvertently been overly conservative, since currently we are in essence using 'ultimate' loads for R but treating them as service loads in the load combination equations.

Part I Strength Design
Similar to how the load factor on Wind was reduced from 1.6 to 1.0 for Strength Design combinations where wind was the principal load, because the ICC 500 standard uses an ultimate wind speed, the 1.6

load factor on Rain for strength design should also be changed to 1.0 for combinations where they are the principal loads (equations 3-7, 3-8, 3-9), because we are using 'ultimate' loads instead of service loads for rain for hurricane shelters. The 1.6 factor on these loads that remains in ASCE 7 is because they are still service level loads in ASCE 7, not ultimate loads. In ASCE 7-22, where the snow load provisions were updated to yield ultimate loads, the Strength Design load factor was reduced from 1.6 to 1.0.

Given the greater spatiotemporal correlation between these hazards and live loads for storm shelters, compared to the general population of buildings represented in ASCE 7, no change is proposed for cases where Rain loads are NOT the Principal Load but rather the arbitrary point in time loads (eqns3-7, and 3-9). Therefore the load factor would remain as 0.5, similar to how wind load is treated in equations 3-3 and 3-8 where wind is not the Principal Load

1.4D (equations 3-1 & 3-6) are deleted because they do not contain tornado or hurricane loads and addressed in the *applicable code.*

Part II ASD
Similar to how the ASD load factor on Snow was reduced from 1.0 to 0.7 in ASCE 7-22, when snow loads were changed from service loads to ultimate loads, it is proposed to reduce the Rain Load by 0.7 in equations 3-22, 3-23, and 3-25.

Committee Action: Approval as submitted (Vote:11-0-0)

Modification (if any):

Committee Reason: Removal of the dead load combination eliminates redundancy because this is only load provisions related to the storm shelter design. Changes to the load factor on rain loads are ultimate loads, not service level loads.

Errata to 03-01-21- The bracket in front of L_{rH} is in the wrong location in equations 3-7. 3-9, 3-23 and 3-25. It should not have moved. Correct revisions are indicated below. Identified and approved by the committee on 10/24/2023.

Replace the following equations in the proposal –

302.2 Strength design. …
For *hurricane shelters*:
$1.2D + 1.6L + 0.5(L_{rH}$ or $1.0R_H)$ (Equation 3-7)
$1.2D + 1.0W_H + L + 0.5(L_{rH}$ or $1.0R_H)$ (Equation 3-9)

302.3 Allowable stress design….
For Hurricane Shelters:
$D + 0.75L + 0.75(L_{rH}$ or $0.7R_H)$ (Equation 3-23)
$D + 0.75L + 0.75(0.6W_H) + 0.75(L_{rH}$ or $0.7R_H)$ (Equation 3-25)

Report for *03-01– 23*		
Committee decision: AS	***Committee Vote at Meeting:11-0-0***	***Committee Vote on Ballot: 13-0***
REPORT OF HEARING: Modification (if any):		
Committee Reason: Removal of the dead load combination eliminates redundancy because this is only load provisions related to the storm shelter design. Changes to the load factor on rain loads are ultimate loads, not service level loads.		
FINAL ACTION: Modification (if any):		
Committee Reason:		

Reconsideration

IS-STM 03-01- 23
302.2, 302.3

Proponent: ICC 300 Work Group 3

Further revise current draft text as follows:

SECTION 302
LOAD COMBINATIONS

302.1 General. The *storm shelter* shall be designed to resist the load combinations specified in Section 302.2 or 302.3. *Storm shelters* that are designed as combination tornado and *hurricane shelters* shall comply with requirements for both sets of load combinations using either Section 302.2 or 302.3.

302.2 Strength design. Where strength design or load and resistance factor design (LRFD) is used, *storm shelters* and portions thereof shall be designed to resist the most critical effects resulting from the following combinations of factored loads. Each load combination shall also be investigated with one or more of the variable loads set to zero.

For *tornado shelters*:

$1.2D + 1.6L_T + 0.5L_{rT}$ **(Equation 3-1)**
$1.2D + 1.6\ L_{rT} + (L_T$ or $0.5\ W_T)$ **(Equation 3-2)**
$1.2D + 1.0W_T + L_T + 0.5\ L_{rT}$ **(Equation 3-3)**
$0.9D + 1.0\ W_T$ **(Equation 3-4)**

For *hurricane shelters*:

$1.2D + 1.6L + 0.5(L_{rH}$ or $1.0R_H)$ **(Equation 3-5)**
$1.2D + (1.6L_{rH}$ or $1.0R_H) + (L$ or $0.5W_H)$ **(Equation 3-6)**
$1.2D + 1.0W_H + L + 0.5(L_{rH}$ or $1.0R_H)$ **(Equation 3-7)**
$0.9D + 1.0\ W_H$ **(Equation 3-8)**

In addition, for *hurricane shelters* subject to the requirements of Section 402.1 and located in:

Coastal high-hazard areas or a *Coastal A Zone:*

$1.2D + 1.0W_H + 2.0F_{aH} + L + 0.5(L_{rH}$ or $1.0R_H)$ (Equation 3-9)
$0.9D + 1.0W_H + 2.0F_{aH}$ (Equation 3-10)

All other locations:

$1.2D + 0.5W_H + 1.0F_{aH} + L + 0.5(L_{rH}$ or $1.0R_H)$ (Equation 3-11)
$0.9D + 0.5W_H + 1.0F_{aH}$ (Equation 3-12)

302.3 Allowable stress design. Where allowable stress design (ASD, working stress design) is used, storm shelters and portions thereof shall be designed to resist the most

critical effects resulting from the following combinations of loads. Each load combination shall also be investigated with one or more of the variable loads set to zero.

For Tornado Shelters:

$D + L_T$ (Equation 3-13)
$D + L_{rT}$ (Equation 3-14)
$D + 0.75L_T + 0.75L_{rT}$ (Equation 3-15)
$D + 0.6W_T$ (Equation 3-16)
$D + 0.75L_T + 0.75(0.6W_T) + 0.75L_{rT}$ (Equation 3-17)
$0.6D + 0.6W_T$ (Equation 3-18)

For Hurricane Shelters:

$D + (L_{rH}$ or $0.7R_H)$ (Equation 3-19)
$D + 0.75L + (0.75L_{rH}$ or $0.7R_H)$ (Equation 3-20)
$D + 0.6W_H$ (Equation 3-21)
$D + 0.75L + 0.75(0.6W_H) + 0.75(L_{rH}$ or $0.7R_H)$ (Equation 3-22)
$0.6D + 0.6W_H$ (Equation 3-23)

In addition, for Hurricane Shelters subject to the requirements of Section 402.1 and located in:

Coastal high-hazard areas or a *Coastal A Zone:*

$D + 0.6W_H + 1.5F_{aH}$ (Equation 3-24)
$D + 0.75L + 0.75(0.6W_H) + 0.75(L_{rH}$ or $0.7R_H) + 1.5F_{aH}$ (Equation 3-25)
$0.6D + 0.6W_H + 1.5F_{aH}$ (Equation 3-26)

All other locations:

$D + 0.75L + 0.75(0.6W_H) + 0.75(L_{rH}$ or $0.7R_H) + 0.75F_{aH}$ (Equation 3-27)
$0.6D + 0.6W_H + 0.75F_{aH}$ (Equation 3-28)

Reason: Proposal 03-01-23 made changes to the load factor on rain loads for hurricane shelters (R_H). These changes were made to correct an inadvertent and overly conservative treatment of rain loads. We have been using a 10,000-year, strength-level loading condition for rain (i.e., ultimate load), but load factors for a service-level rain load in the load combinations. Proposal 03-01-23 was developed and approved by WG-3 and the Committee to correct this oversight. At the time 03-01-23 was developed, it did not include parallel changes to the load combination including flood loads. That is because our Committee was evaluating the draft of ASCE Supplement 2 at the time for potential adoption or adaptation into ICC 500-2023. Such a change would have potentially impacted the load combinations as well. When the decision was made not to adopt any changes related to the new ASCE 7 flood supplement, we forgot to go back and update the flood load combinations. This creates an inconsistency problem with the load factor on rain loads between the combinations including flood and the combinations that do not include flood.

Two changes are needed to correct this issue.

1. Equations 3-9 and 3-11
   For strength load combinations for flood, the term "R_H" in the flood load combinations is replaced with "$1.0R_H$". Note – this is not a technical change and is provided here for information only. This is a format change for consistency with previously approved strength load combinations including R_H, and with ASCE 7. The 1.0 is representative of the fact that rain load is a strength level load (similar to treatment of wind with 1.0W). Live loads and dead loads are still input as service level loads, hence the use of L and D instead of writing them as 1.0L and 1.0D.

2. Equations 3-25 and 3-27
   For allowable stress load combinations (ASD), the factor on rain loads in the flood load combinations changes from one to 0.7. This is for consistency with the already approved ASD load combination changes. As described in the original proposal, the reduction in the load factor effectively modifies the rain load from a strength-level load to a service-level load, which is needed for the ASD load combinations.